RoboCup American Open

Rescue Robot League

Rules

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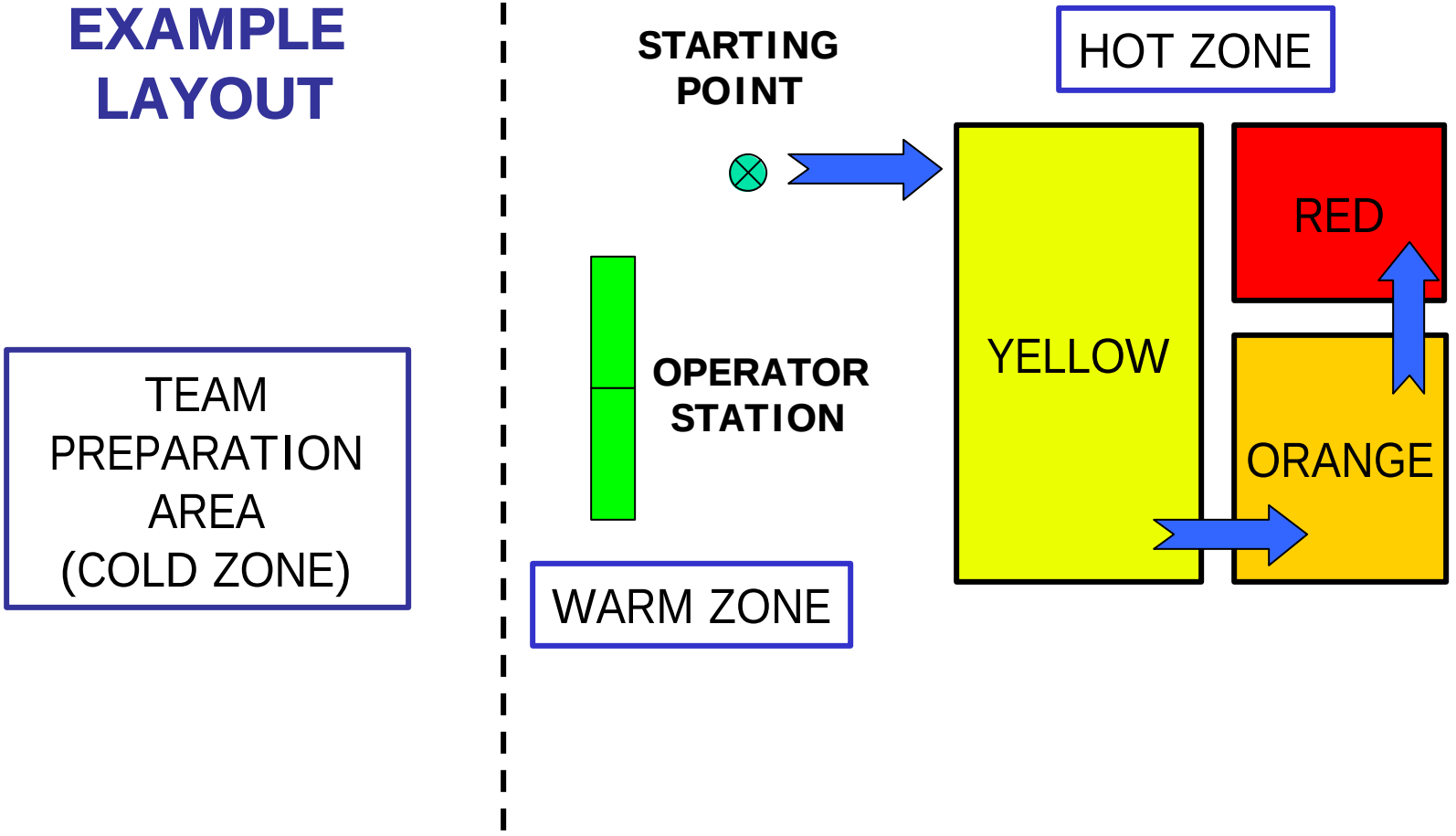
These are subject to change at the discretion of the event chair.

Competition Rules Review

- 1 – Field of Play
- 2 – Victims
- 3 – Operators
- 4 – Player’s Equipment
- 5 – Judge
- 6 – Referees
- 7 – Match
- 8 – Start and Restart
- 9 – Scoring and Awards
- 10 – Other

Rule (1): Field of Play

EXAMPLE LAYOUT



Rule (1): Field of Play

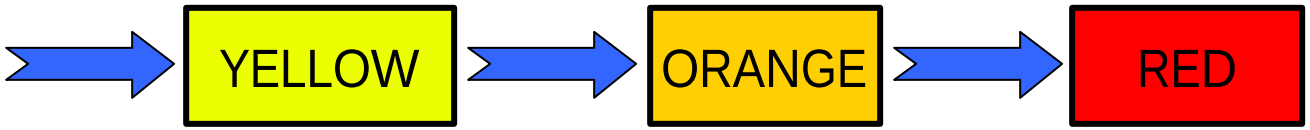
“Hot Zone”

- Yellow Arena
  - 2-D maze with no flooring issues
  - Victim weighting = 0.5
- Orange Arena
  - 3-D maze with variable household/office flooring
  - Victim weighting = 0.75
- Red Arena
  - Totally unstructured and unstable
  - Victim weighting = 1.0
- No operators or team members allowed in the field of play at any time!

Rule (1): Field of Play

“Hot Zone” – Sequential Navigation

- Robots must negotiate the easier domains before attempting more difficult ones.



Intent of Rule:

- *Encourage multi-robot collaboration, i.e. sharing maps*
- *Discourage parallel tele-operation between two or more arenas*
- *Discourage sequential tele-operation of multiple robots*
- *Force robots through specific obstacles*

Rule (1): Field of Play

“Warm Zone”

- Operator station
  - Faces away from “Hot Zone”
  - Be careful NOT to have non-essential team members present in operator station during run
- Starting Point
  - Any or all team members place and initialize robot prior to run
  - All team members present in the “Warm Zone” during a run are counted as operators
- Any member of a team found in the “Warm Zone” during another team’s run will be penalized at the discretion of the co-chairs.

Rule (1): Field of Play

"Cold Zone"

- Contains Team Preparation/Staging Area
- All team members must stay in this area during the competition or be counted as an operator

Rule (2): Victims

- Humanoid mannequins displaying signs of life
  - Audible: Voice, beacons, tapping, shifting debris...
  - Thermal: Body heat (heating pads and blankets)
  - Human Form: Shape, Color, …
  - Motion: Moving appendages,...
  - Chemical: CO_2 emission
- Various Placements
  - Surface
  - Lightly trapped
  - Void
  - Entombed
- Various states
  - Conscious
  - Semi-conscious
  - Unconscious

Rule (2): Victims

MOVING FINGERS AND ARMS

TAPPING

LOCATOR CHIRP

VOICE

BODY HEAT

CO2 EMISSION

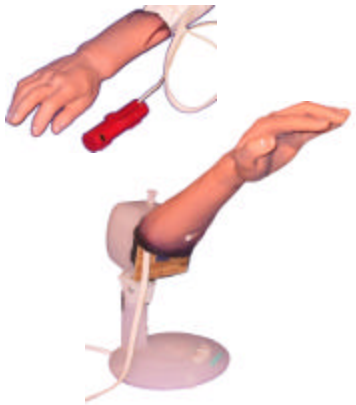
HUMAN FORM

CLOTHING: DUST COVERED OR COLORFUL

MULTI-CULTURAL SKIN TONES

REFLECTIVE TAPE

LOCATOR STROBE



Rule (3): Operators

- Any person present in the “Warm Zone” during a run
- Any person who touches, interacts with, or controls a robot during a run

Intent of Rule: To minimize the amount of operators, thereby encouraging bounded autonomy and high level management of multiple robots.

Rule (4) - Player's Equipment

Communication

- Allowed between robots and operators
- Operators must maintain their means of communication
- A schedule will be created during setup to provide teams the opportunity to test their wireless hardware without interference from other robot rescue teams
- Interference from outside sources (i.e. vendors, etc,…) will be addressed by the co-chairs

Map Generation

- A map must be produced to communicate the locations of each victim found to be counted towards scoring

Rule (5): Judge

- An organizing committee member
- Responsibilities during each run
  - starts the official time
  - only official allowed to interact with the operator (s)
  - relays to the referees that a potential victim has been found
- Responsibilities after each run
  - interprets the map to seek each victim
  - determines the positional accuracy and map quality
  - verifies sensor ids
  - calculates the score
- Has final authority over any disputes

Rule (6): Referees

- Either organizing officials or non-competing team members
- Responsibilities
  - tracks the robot through the run
  - notes victim identifications
  - assigns penalties (arena damage and victim harm)
- One referee per robot
- Must observe from the perimeter of the arenas
- Is not allowed to interfere with the robot

Rule (7): Match

- All teams will be divided into several groups (number to be determined by the co-chairs)
- Preliminary round: All teams – Number of runs TBD
- Final round: Top one or two (TBD) teams from each group – number of runs TBD
- Total score per round = Sum of two best scores

Rule (7): Match

- To score points, teams must draw a map of arenas to indicate victims' position and present it to the judge within 2-10 minutes (final time TBD by co-chairs)
- Robots do not have to return to the Starting Point at the conclusion of the round to receive a score
- Restrictions
  - All activities outside the arenas are invalid
  - Competitors cannot see nor enter the "Hot Zone"
  - Violation of any rule results in disqualification from league
  - Any mappings which indicate a priori knowledge of the arenas will result in immediate disqualification

Rule (8): Start & Restart

Start

- Operator(s) will place their robot at the Starting Point in the “Warm Zone” during the preparation time
- Judge will indicate when official run time has started

Rule (8): Start & Restart

Restart

- Operator can call ‘RESET’
  - Judge returns robot to the “Starting Point”
  - Time continues to run
  - Penalty: add one operator to the score
- ‘Self-RESET’
  - Robot can return to starting zone by itself for operator’s repair
  - Penalty: none (time continues to run)
  - Operator(s) can continue setup during run time
- ‘Out of Bounds RESET’
  - Occurs when a robot leaves both the ‘HOT’ and ‘WARM’ zones
  - Imposed at the discretion of the judge
  - Penalty: add one operator in score

Rule (9): Scoring

Goal

- Reward teams that provide accurate and detailed maps for judges to locate victims
- Reward robots that can identify multiple signs of life on individual victims
- Encourage autonomy among multiple robots
- Minimize physical interaction between robots and arenas/victims

Rule (9): Scoring

Place Awards

- 1st, 2nd, and 3rd place awarded based upon the teams' quantitative performance scores

Minimum Score

- Required for place award
- To be determined by the co-chairs after the preliminary round

Rule (9): Scoring Formula

COMING SOON!

- The scoring formula will be based upon that used at the RoboCup2002 and AAAI2002 Competitions.

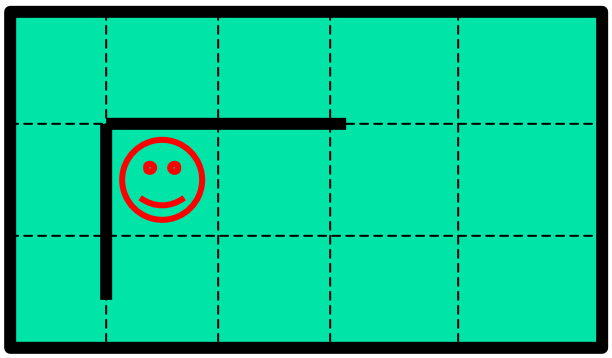
- Improvements to last year's metric are currently being discussed.

Rule (9): Victim Identification

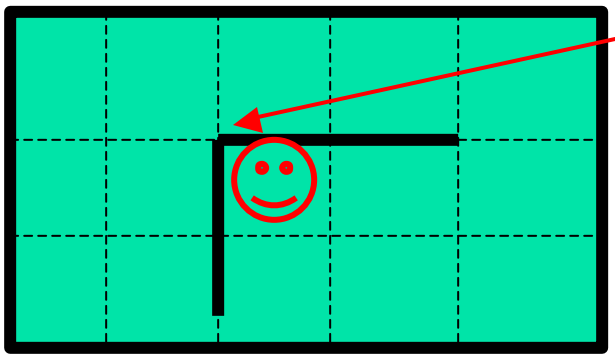
- Operator must say “Victim Found” to judge
- Operator must state all perceived signs of life
  - Judges (with the operator) note the validity of the call based on the information shown in the operator interface
  - Referees (with the robot) note the order that the victims are found
- Each victim found has three scoring components:
  - Positional Accuracy (0.25 – 1 point)
  - Map Quality (0 – 1 point)
  - Sensor ID (.2 – 1 point)

Rule (9): Victim Identification

- Positional Accuracy
  - Operator maps the position of a found victim by grid cube
  - Grid coincides with arena wall and floor panels
  - Grid is approximately 1.2m (~4ft) x 1.2m x 1.2m for NIST-based arenas
  - Grid may change in size depending on the dimensions of the local arenas



Real Situation

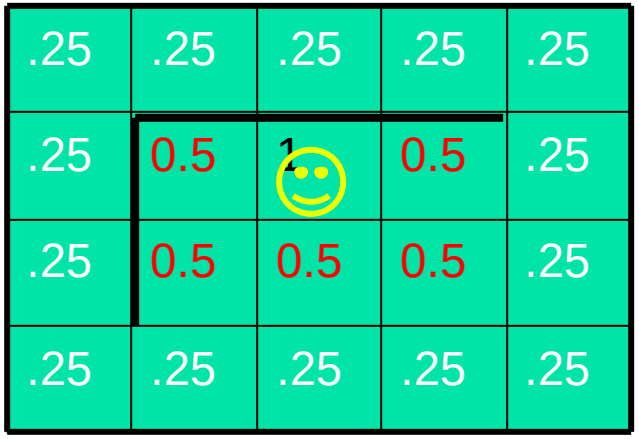


Map Drawn

This is OK!!

Rule (9): Victim Identification

- Positional Accuracy
  - When a victim is large and is included in multiple grids, any grid containing the victim can be called
    --> PositionalAccuracy = 1
  - Adjacent grid is called
    --> PositionalAccuracy = 0.5
    Cannot propagate beyond wall
  - Any other grid is called
    --> PositionalAccuracy = 0.25



Rule (9): Victim Identification

- Map Quality
  - No idea where robot traveled even if victims are found

    --> MapQuality = 0
  - Single direction to victim from known start position
    --> MapQuality = 0.2
  - Basic topographic information to get to the victim (ex. 1st right, 2nd left)
    --> MapQuality = 0.4
  - Hand drawn map with victim locations
    --> MapQuality = 0.8
  - Computer-generated, accurate 2-D map with victim location
    --> MapQuality = 1.0

There is no risk in attempting more ambitious mapping

Rule (9): Victim Identification

- Sensor ID
  - Unique sign of life (Audio, Thermal, Form, Motion or Chemical)
  - Multiple Sensor IDs make up victims
  - Sensor ID must be detected for it to be awarded in scoring
  - Sensor ID = (IDs found on victim)/(Total IDs on victim)
  - Example:

    Sensor ID = .667 = 2 (Form & Motion Detected)
    3 (Form, Motion & Thermal Present)

Rule (9): Penalties

- Arena Penalties
  - Uncontrolled Bumping (0.25 point loss per incident)
    - Undesirable contact that does not result in any damage
  - Heavy Damage (0.75 point loss per incident)
    - Undesirable shifting or damage to arena components
- Victim Penalties
  - Bumping Victim (0.25 point loss per incident)
    - Any contact with a victim
  - Harming Victim (0.75 point loss per incident)
    - Any contact that repositions or ‘harms’ the victim
- Penalties Compound

  Ex. - Causing ‘Heavy Damage’ to arenas that results in ‘harming’ a victim

  Point Loss = 0.75 + 0.75 = 1.5

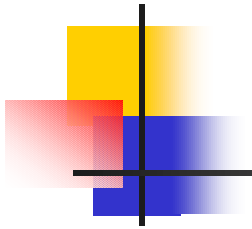
Rule (9): Qualitative Awards

To Be Determined by Co-Chairs

Rule (10): Other

- Team Report
  - All teams that receive either a place or qualitative award must provide a document outlining the hardware and software specifications of their robots within 30 days of the last day of competition.
  - Any team that has signed with a non-disclosure agreement with a third party regarding their robot's hardware or software must inform the co-chairs prior to competition.

- Protests and Rule Changes
  - All protests must be filed with the co-chairs before the start of the following round.
  - Rule changes may be proposed by any team captain. Co-chairs will consider such changes and make decisions in same day.



Questions ??